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ABSTRACT OF THE DISCLOSURE

When a device using GaN semiconductors is made on a hard and chemically stable single-crystal substrate such as sapphire substrate or SiC substrate, a semiconductor device and its manufacturing method ensure high-power output or high-frequency operation of the device by thinning the substrate or making a via hole in the substrate. When a light emitting device using GaN semiconductors is made on a non-conductive single-crystal substrate such as sapphire substrate, the semiconductor device and its manufacturing method reduce the operation voltage of the light emitting device by making a via hole to the substrate. More specifically, after making a GaN FET by growing GaN semiconductor layers on the surface of a sapphire substrate, the bottom surface of the sapphire substrate is processed by lapping, using an abrasive liquid containing a diamond granular abrasive material and reducing the grain size of the abrasive material in some steps, to reduce the thickness of the sapphire substrate to 100  $\mu\text{m}$  or less. Thereafter, the bottom surface of the sapphire substrate is processed by etching using an etchant of phosphoric acid or phosphoric acid/sulfuric acid mixed liquid to remove a strained layer by lapping. Then, after making a via hole by etching the bottom surface of the sapphire substrate by using a similar etchant, the GaN

semiconductor layer at the bottom of the via hole is removed by RIE to expose a Au pad electrically connected to the source of GaN FET. Thereafter, a thick Au film electrically connected to the Au pad is made through the via hole. The via hole may be made by irradiation of a pulse laser beam from a CO<sub>2</sub> laser and subsequent etching.

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